RESEARCH PAPER

Dental Students' Knowledge, Awareness, and Attitude Toward the Oral-Systemic Health Link: A Diagnostic and Professional Perspective

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ABSTRACT

Background: The "Oral-Systemic Link" represents the reciprocal connection between oral pathologies and chronic systemic illnesses. With the medical field's transition toward collaborative care, it is essential that dental students develop the proficiency to identify these associations. This study assesses student understanding, recognition, and professional perspectives concerning the influence of oral health on general health & wellbeing and their contribution to interdisciplinary health teams.

Methodology: This study incorporates a structured psychometric questionnaire divided into three domains: Cognitive (based on knowledge), Perception (awareness), Attitude (ethical work behaviour) comprising of simple questions connecting oral health & systemic health.

Results: This study reveals that 60% of study population (dental students both male, female including) have awareness of common associations (e.g., Diabetes and Periodontitis), but only 13% of them have understanding of the biochemical pathways highlighting a significant gap in their knowledge. Although 69% of the population know that many systemic diseases have oral manifestation but only 34% strongly agree on utilizing salivary diagnostic tests for exploring systemic diseases and the clinical application of salivary diagnostics.

Conclusion: Students demonstrate a positive attitude toward integrated care, yet curricula require a stronger focus on interprofessional education (IPE) to bridge the gap between theoretical knowledge and clinical self-efficacy.

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Introduction:

Dentistry was practiced as a surgically-oriented, localized discipline in the earlier times. However, recent scientific advances have redefined the practice of dentistry.[1] Oral health is inextricably linked to general physiological status and to an extent mental well-being.[2] This Oral-Systemic Link is characterized by a bidirectional flow: systemic diseases frequently manifest with oral symptoms, while chronic oral inflammation, specifically periodontitis, acts as a persistent source of systemic inflammatory mediators leading to various diseases in future.[3,4]

The pathogenesis of periodontal disease is initiated by pathogens like Porphyromonas gingivalis, this pathogen triggers an inflammatory reaction, further leading to increase in inflammatory mediators like interleukin-6 (IL-6) and C-reactive protein (CRP), this progresses to systemic inflammation, worsening progression to diseases like type 2 diabetes mellitus, furthermore other inflammatory diseases like atherosclerosis, high risk of adverse pregnancy outcomes.[5]

A study conducted by Nazir et al., highlights that while the majority of dentists possess a satisfactory level of awareness regarding the oral-systemic link—particularly the association between periodontal disease and systemic conditions like Diabetes Mellitus and Cardiovascular Disease—there remains a notable gap in translating this knowledge into clinical practice. A significant portion of practitioners do not routinely perform systemic health screenings, such as blood pressure monitoring or blood glucose checks,

nor do they consistently refer patients to medical specialists.[6]

The role of the Hypothalamic-Pituitary-Adrenal (HPA) axis and the potential of salivary biomarkers, such as cortisol, are emerging as critical diagnostic frontiers in the dental setting.[7]

Despite the clinical importance, the transition to a medically-integrated model depends heavily on the "competency" of future dental practitioners. Various researchers have highlighted the fact that dental students have a readiness to acquire knowledge about the possible links between oral & systemic health.[6,8]. Studies have revealed that the awareness levels differ between clinical and pre-clinical years, suggesting that as students' progress, they often lose sight of systemic connections in favour of technical dental skills.

In a study done by David W Paquette et al, on 667 dentists revealed dentists were most confident in the link between periodontitis and diabetes, but showed significantly less awareness regarding the associations with Adverse Pregnancy Outcomes and Respiratory Diseases.

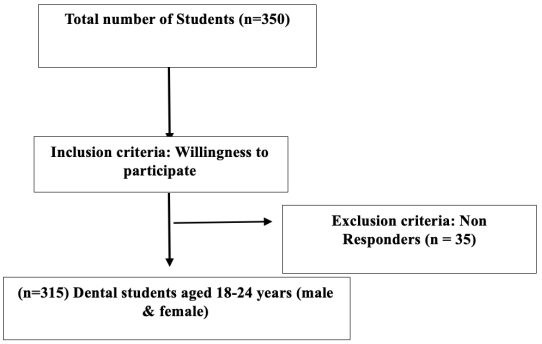
While the existing research reveals a significant acceptance amongst the dental students regarding the oral-systemic link, but gap remains between identifying disease associations and understanding the specific biochemical mechanisms and diagnostic pathways that connect them.

This study aims to evaluate the current knowledge, awareness, and attitudes of dental students to pinpoint specific educational gaps, providing a foundation for academic institutions to refine their curricula. By transitioning from a traditional, mechanically focused training model to a comprehensive, medically integrated approach, the research seeks to transform dentistry from a purely surgical discipline into a holistic field. Ultimately, this shift aims to equip future practitioners with the diagnostic proficiency necessary to identify systemic risks and effectively manage refractory cases through integrated health screening.

Material & Methods:

This study was conducted in a dental college and hospital after ethical approval, a total of 315 students (within age group of 18-24 years, including both male & female) participated in this cross-sectional questionnaire-based study. The study participants were selected on the basis of their willingness to participate in the study, after obtaining their consent.

The questionnaire was a google form consisting 3 broad sections -**Cognitive** (based on knowledge) consisting of 10 questions, **Perception** (awareness) consisting of 5 questions, **Attitude** (ethical work behaviour) consisting of 5 questions.



Survey Instrument: The Questionnaire's Structure:

A self-formulated tailor-made questionnaire was designed & validated. The questionnaire is inclusive of 3 broad domains- **Cognitive** (based on knowledge), **Perception** (awareness), **Attitude** (ethical work behaviour) compromising of simple questions connecting oral health & systemic health. The mean CVR (essentiality of the questions) was 0.930, indicative of greater agreement among panel members (the experts & the observer). Based on the response by experts & observer the relevance was S-CVI/Ave ≥ 0.9 indicative of have excellent content validity. The mean score on clarity of data was 0.920, which signifies the questions are clearly understandable.

The questionnaire also includes information on demographic Data, basic information about the participants, such as their gender and academic year. The first set of questionnaires focus mainly on Knowledge these questions assess the clinical understanding of how oral diseases affect the body, specifically looking for the "how" and "why" behind disease progression. Also highlighting an intricate relationship testing the knowledge of how dental treatments affect medical markers and how medications for systemic issues impact dental procedures.

The second component of the assessment utilizes a **Yes/No/Don't Know**, scale to measure the perceptual and affective domains of professional identity. This section gauges the respondent's sense of professional responsibility regarding systemic health screening and their valuation of oral care in improving the quality of life for individuals. Additionally, it evaluates the student's propensity for holistic diagnosis—specifically their consideration of systemic stress in

refractory cases—while providing an educational appraisal of how effectively the current dental curriculum emphasizes the oral-systemic link.

The final section includes a **5-point Likert** (Strongly disagree, disagree, neutral, agree, strongly agree) scale to evaluate the affective domain, specifically focusing on the internalized professional values and ethical beliefs of the respondent. It explores the clinician's clinical philosophy regarding the indispensability of thorough medical histories and interdisciplinary teamwork with medical peers. Furthermore, it gauges the respondent's diagnostic identity by measuring the importance they assign to identifying early oral markers of systemic malignancies or autoimmune disorders. Finally, the section assesses innovation openness, capturing perspectives on the clinical utility of pioneering diagnostic tools, such as the use of salivary cortisol to monitor systemic health within a dental environment.

Statistical analysis:

Results for the three categories were expressed in percentages. Each response obtained was evaluated on basis of scores they obtained in sections of knowledge, awareness and attitude. The entire analysis process was done in SPSS software 9.4.

Result:

Figure No.1: Pie chart depicting distribution of study population according to gender

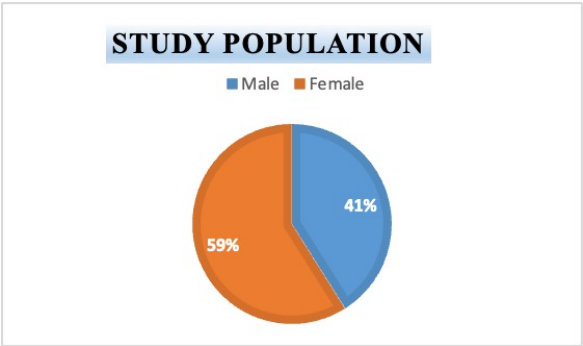


Table no. 1: Mean percentage of knowledge-based questions score responses obtained from volunteers:

Knowledge based questions:	Correct	Incorrect
Which oral disease is most consistently and strongly linked to the exacerbation of systemic conditions like Diabetes Mellitus?	60	40%
What is the primary mechanism hypothesized for the link between periodontal disease and Cardiovascular Disease (CVD)?	13%	87%
Which oral manifestation is a classic sign of uncontrolled Diabetes Mellitus?	36%	64%
Non-surgical periodontal therapy in a diabetic patient has been shown to potentially improve which systemic marker?	48%	52%

The presence of which oral lesion is strongly associated with HIV/AIDS and often is the first sign of immune compromise?	43%	57%
What is the term for a local anesthetic complication that can occur in patients taking non-selective beta-blockers?	17%	83%
Which systemic condition increases a pregnant patient's risk of developing Pregnancy Gingivitis?	34%	66%
A strong association exists between untreated periodontal disease and which adverse pregnancy outcome?		
How do chronic oral inflammatory diseases (like Periodontitis) influence systemic cortisol levels?	23%	77%
Osteoporosis is linked to alveolar bone loss in the jaw. This bone loss may potentially increase the risk of:	40%	60%

Figure No. 2: Result of Knowledge based question

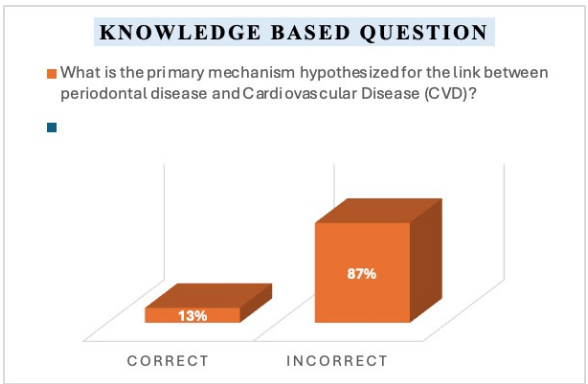


Table no. 2: Mean percentage of awareness-based questions score responses obtained from volunteers:

Awareness questio	Yes	No	Don't Know

nnaire (Yes/No/Don't Know)			
I Do not believe that a dental professional has a responsibility to screen patients for systemic health risks (e.g., refer for diabetes testing)?	28%	71%	1%
Are you aware that a significant portion of systemic diseases (over 90%) may have oral manifestations?	69%	31%	0
Do you believe that treating chronic oral infections can improve overall quality of life (e.g., ability to chew, speak, socialize) in medically compromised patients?	55%	45%	0
In your clinical training, do you consider a patient's systemic stress levels when diagnosing "refractory" periodontitis (periodontitis that does not respond to conventional treatment)?	4%	71%	25%
Do you agree	25%	75%	0

that the oral-systemic link is a primary focus area in your dental curriculum?			

Figure No. 3: Result of Awareness based question

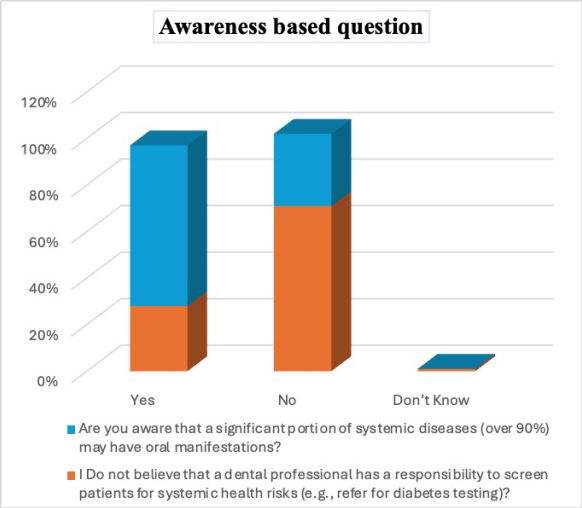


Table no. 3: Mean percentage of attitude-based questions score responses obtained from volunteers:

Attitude (5-Point Likert Scale)	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is essential for a dentist to routinely take a comprehensive medical history, regardless of the patient's chief complaint.	0%	2%	0%	78 %	20 %
Collaboration and communication with medical physicians are necessary for the effective management of patients with systemic diseases.	2%	4%	25 %	20 %	49 %
I believe that the success of my periodontal treatment is influenced by the patient's control of their systemic conditions	2%	15 %	41 %	40 %	2%
I believe that early diagnosis of oral signs of systemic disease (e.g., Sjogren's Syndrome, Leukemia) is a critical role for the dentist.	0%	10 %	59 %	20 %	11 %
"In my opinion, measuring salivary cortisol could be a useful diagnostic tool in a dental setting to monitor a patient's systemic health."	0%	4%	48 %	14 %	34 %

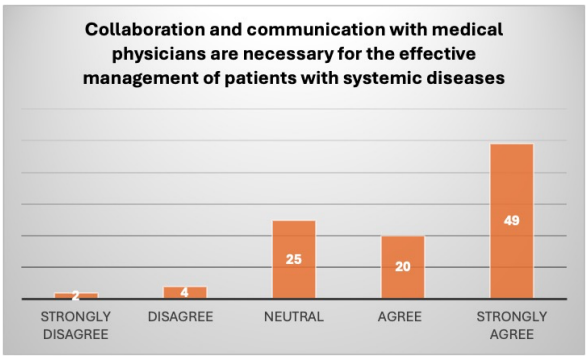


Figure no. 4: Result of Attitude based question

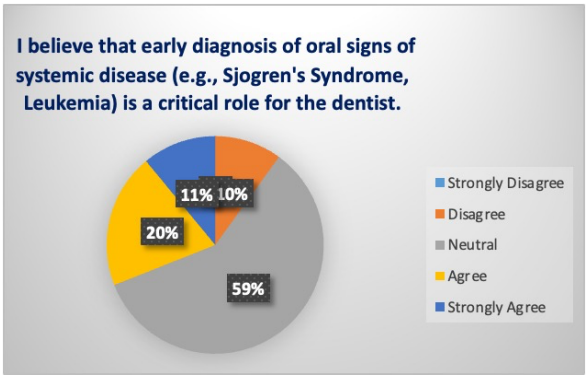


Figure no. 5: Result of Attitude based question:

Discussion:

The present study reveals the level of general knowledge, awareness & attitude towards the oral-systemic health amongst dental college students of either sex.

Figure no. 1 show, the details of study population amongst the volunteers were 59% female & 41% male.

The systematic review by Jiang et al. demonstrates that while dental students' professional awareness and scores improve as they progress through their clinical years, a notable disconnect persists between their theoretical knowledge and practical application.[9]

Table no. 1, presents a set of questions and response highlighting the knowledge of volunteers the questions focus on core understanding of the dental students about the pathogenesis of various systemic diseases linking the oral inflammatory diseases. **Table no.1 & figure no.1,** reveals 87% don't know the correct mechanism which explains a link between periodontal diseases and development of cardiovascular diseases. A study done by Bawankar PV et al, aligns with our finding the research underscores a significant lack of understanding and a pervasive indifference among patients regarding the reciprocal link between cardiovascular disease (CVD) and periodontal health. Furthermore, it identifies a notable gender gap, revealing that knowledge and awareness levels concerning this systemic connection vary considerably between men and women.[10]

Researchers have highlighted and explained the connection between periodontal disease and cardiovascular health is a complex. The gum disease area far from being localized instead are the ones which can trigger systemic inflammation, allowing oral bacteria and inflammatory markers to enter the bloodstream and accelerate the development of arterial plaques.[11, 12]

In our study, 77% volunteers didn't know how do chronic oral inflammatory diseases (like Periodontitis) influence systemic cortisol levels. Researches have explained the pathogenesis of elevated cortisol in oral inflammatory diseases like periodontitis through the activation of the Hypothalamic-Pituitary-Adrenal (HPA) axis. These inflammatory diseases affect not only physiologically but also psychologically. The persistent discomfort and chronic nature of oral lesions act as a biological stressor, triggering the hypothalamus to release corticotropin-releasing hormone, which eventually prompts the adrenal glands to secrete higher levels of cortisol into the saliva and bloodstream. Furthermore, the study suggests a "vicious cycle" where the elevated cortisol, while initially an anti-inflammatory attempt by the body, eventually dysregulates the immune response, potentially worsening the inflammatory environment of the oral mucosa and reinforcing the systemic hormonal imbalance.[13, 14]

Table no. 2 represents the mean percentage of awareness-based questions score responses obtained from volunteers. In our study 69% of the volunteers are aware that a significant portion of systemic diseases (over 90%) may have oral manifestations.

Napeñas JJ, Brennan MT, Elad S in their study explain how oral cavity serves as a vital diagnostic "window," where early signs of systemic disorders such as autoimmune, blood, digestive, and hormonal disorders often first appear as ulcers, gum swelling, or tissue changes. By highlighting how conditions like Lupus, leukemia, and viral infections (such as HIV) manifest orally, the authors argue that dental exams are essential for the early detection of internal diseases. Ultimately, the research emphasizes that the oral cavity is a key indicator of overall health, requiring dentists and physicians to work together for effective patient care.[15]

Figure no. 3, gives a comparative view of awareness of our volunteers about the oral manifestation of systemic diseases and their agreement on their role as a dental professional to screen patients for systemic health risks (e.g., refer for diabetes testing).

Researchers have putforth the importance of role of a dentist in diagnosis of systemic diseases, chairside screenings for chronic conditions like hypertension and Type 2 diabetes into routine oral care could be a gamechanger for early diagnosis. Because dental professionals often see patients who may not have gone to physicians, they are uniquely positioned to identify "silent" health risks in individuals who might otherwise go undiagnosed. Early intervention and create a critical referral bridge to medical doctors. This multidisciplinary approach not only catches

chronic conditions in their early stages but also shifts the dental office into a proactive public health role, ultimately improving long-term systemic health outcomes for the community. [16]

Table no. 3, reveals responses obtained on attitude-based questions from volunteers. This set of questionnaire assesses how dental students perceive their role in managing overall patient health beyond just the mouth. Specifically, it measures their commitment to the "oral-systemic link" by evaluating their openness to conducting medical screenings, collaborating with physicians, and utilizing modern diagnostic tools like salivary cortisol to monitor systemic conditions.

Figure no. 4, reveals in our study 69% of respondents agree or strongly agree that collaboration and communication with medical physicians are essential for managing patients with systemic diseases. Many researchers have proposed similar acceptance.[17,18]

Figure no. 5, reveals in our study 59% of volunteers are neutral on their view on early diagnosis of oral signs of systemic disease (e.g., Sjogren's Syndrome, Leukaemia) as a dental professional.

Ukwas A, Porter SR et al emphasize in their study that oral healthcare providers are strategically positioned to identify the initial clinical markers of systemic diseases, allowing for earlier medical intervention and improved patient outcomes through timely referals.[19] The research overall highlights that although most dental students are aware that systemic diseases show oral symptoms, they often lack a deep understanding of the biological processes involved, such as how periodontitis triggers cardiovascular issues or influences cortisol via the HPA axis. While there is strong support for collaborating with physicians, many students remain hesitant about their specific responsibility in diagnosing conditions like leukemia or Sjögren's syndrome. To bridge this gap, the study suggests that dental professionals should embrace chairside screenings for "silent" risks like hypertension and diabetes, transforming the dental office into a proactive public health hub and a vital referral link for early medical intervention.

Conclusion:

Our study concludes that dental education must evolve from a technical focus to a medically integrated model to bridge the gap between students' basic systemic Knowledge and their actual clinical confidence and training regarding early diagnosis of various diseases chairside.

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